Plastic Pollution: Coastal and Marine Trends (Microplastics)

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Photo credit: Masaya Maeda, Anacostia Watershed Society

https://www.sciencealert.com/our-oceans-are-full-of-nurdles-and-they-re-not-as-cute-as-they-sound

https://unearthed.greenpeace.org/2017/02/17/hundreds-thousands-plastics-pellets-found-uk-beaches/

Primary

https://blueocean.net/wp-content/uploads/2017/01/Alliance-for-the-Great-Lakes.jpg

https://www.whoi.edu/know-your-ocean/ocean-topics/pollution/marine-microplastics/

Secondary

http://www.huffingtonpost.com/2011/10/26/plastic-ocean-pacific-conservation_n_1032897.html

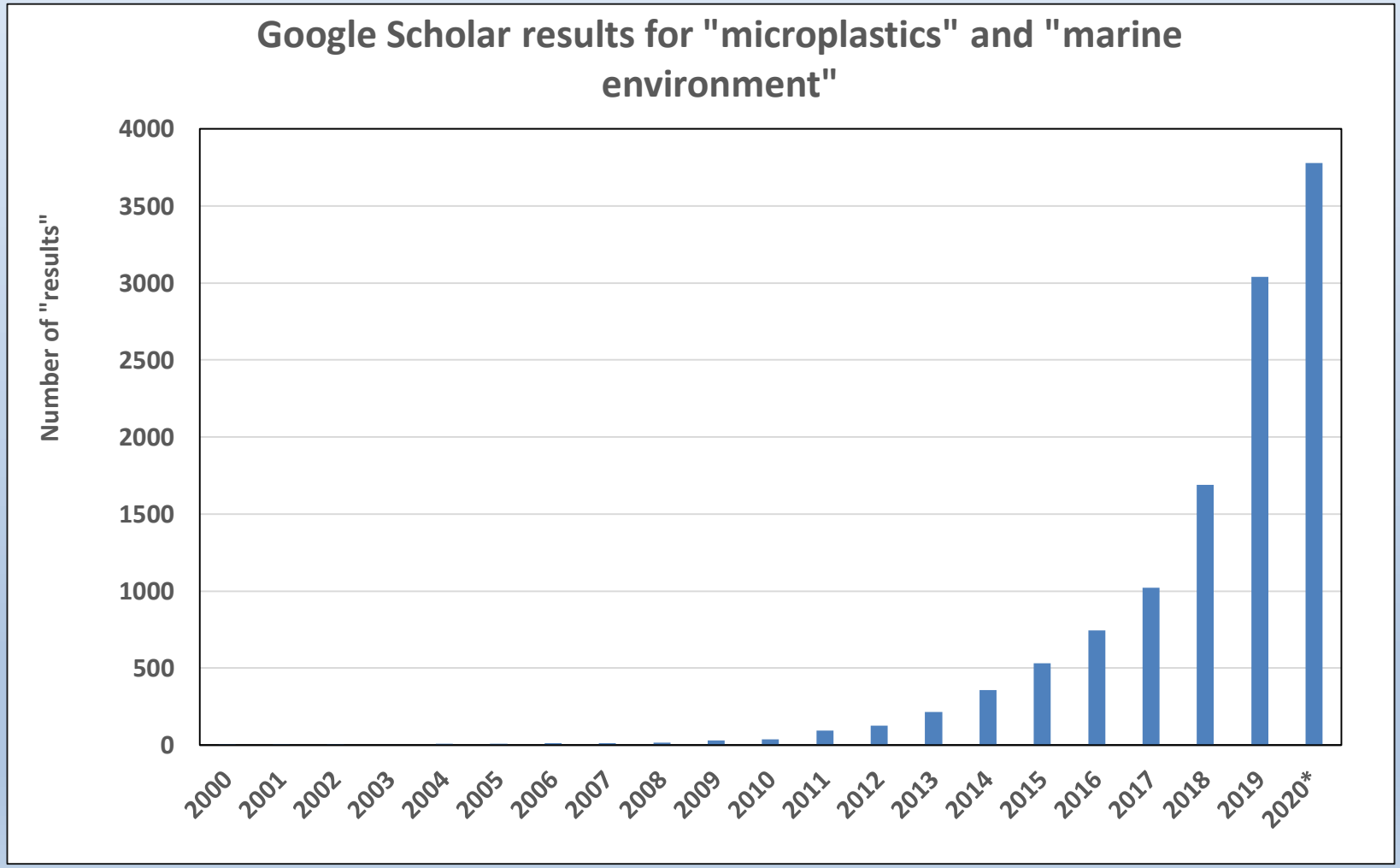
https://bananarepublicfactory

Fibers

http://www.purewatergazette.net/synthetic-fibers-from-clothing-are-becoming-serious-pollutants-january-11-2014/

Microplastics are functionally defined as particles < 5 mm

Microplastics in the Scholarly Literature



Plastics on the Sargasso Sea Surface

Abstract. *Plastic particles, in concentrations averaging 3500 pieces and 290 grams per square kilometer, are widespread in the western Sargasso Sea. Pieces are brittle, apparently due to the weathering of the plasticizers, and many are in a pellet shape about 0.25 to 0.5 centimeters in diameter. The particles are surfaces for the attachment of diatoms and hydroids. Increasing production of plastics, combined with present waste-disposal practices, will undoubtedly lead to increases in the concentration of these particles. Plastics could be a source of some of the polychlorinated biphenyls recently observed in oceanic organisms.*

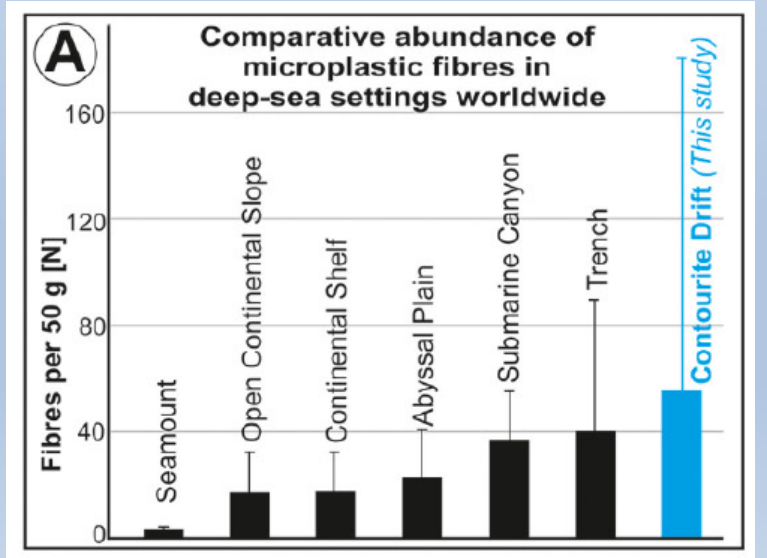
Carpenter et al. 1972. Science

Seafloor microplastic hotspots controlled by deep-sea circulation

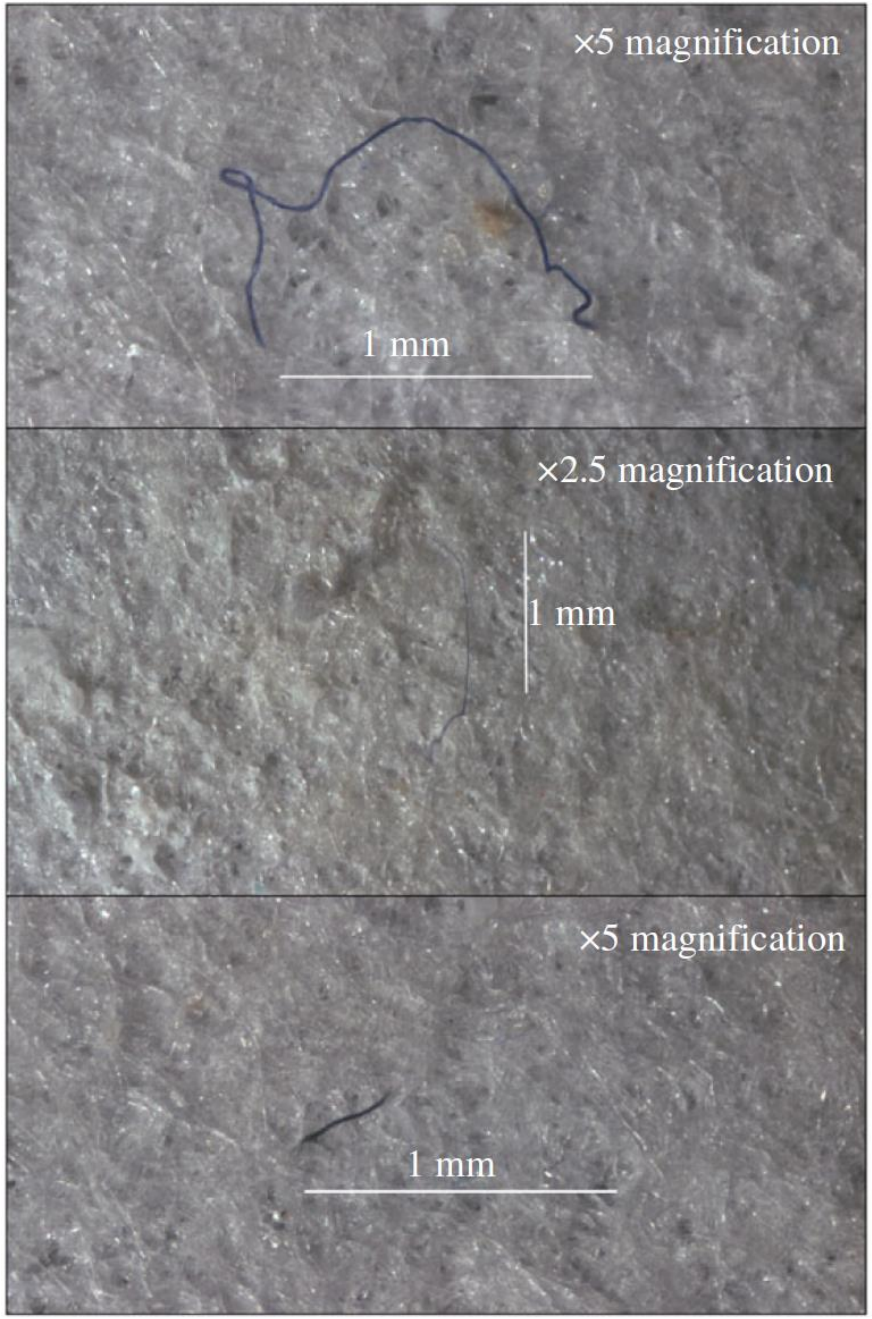
Kane et al. 2020. Science

Anthropogenic debris in seafood: Plastic debris and fibers from textiles in fish and bivalves sold for human consumption

Rochman et al. 2015. Scientific Reports



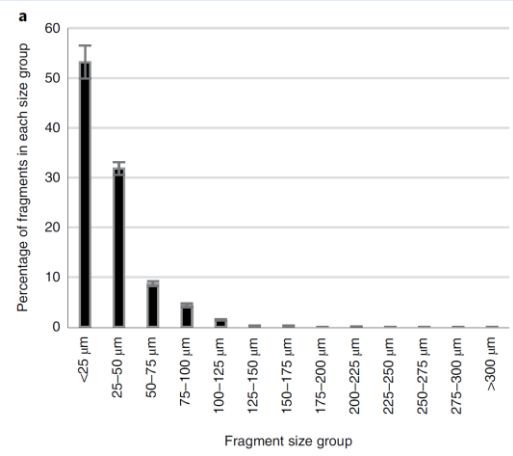
Microplastics and synthetic particles ingested by deep-sea amphipods in six of the deepest marine ecosystems on Earth



Jamieson et al. 2019. Roy. Soc. Open Sci.

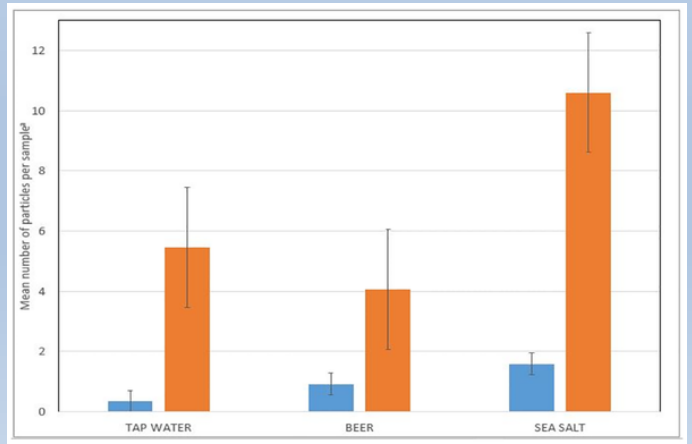
Atmospheric transport and deposition of microplastics in a remote mountain catchment

Allen et al. 2019. Nature Geoscience



Anthropogenic contamination of tap water, beer, and sea salt

Kosuth et al. 2018. PLOS ONE



Microplastics unknown #1:

What are the effects, from the subcellular to population level, of ingesting microplastics?

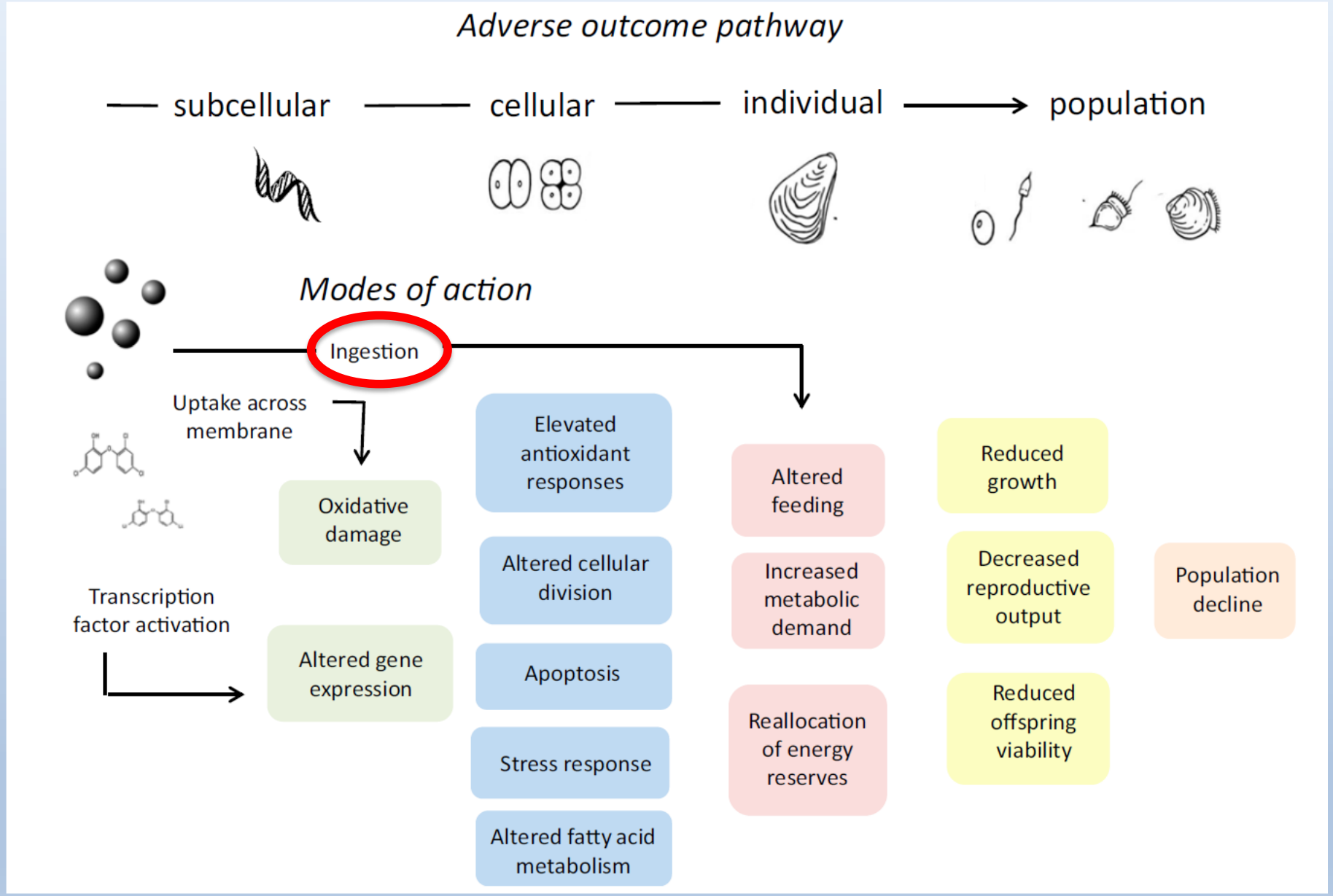


Fig. 1. Tentative AOP scheme for microplastics exposure of aquatic species showing **potential** pathways linking ingestion, uptake across membranes, and chemical release with adverse outcomes of growth inhibition and reproductive decline.

Galloway & Lewis (2016) PNAS 113:2331-2333

Microplastics unknown #2:

How can we fully understand a phenomenon when we measure only a fraction of that phenomenon?

Are We Underestimating Microplastic Contamination in Aquatic Environments?

Jeremy L. Conkle [1] · Christian D. Báez Del Valle [2] · Jeffrey W. Turner [3]

- **Reviewed 50 environmental surveys of microplastic**
- **Most (~80%) account only for plastics ≥ 300 µm**

- **Their investigation of personal care products showed > 95% of particles (by count) were <300 µm minimum diameter**

By mass

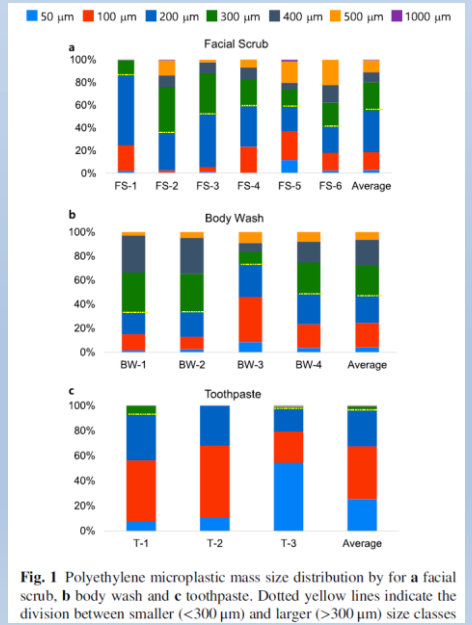


Fig. 1 Polyethylene microplastic mass size distribution by for **a** facial scrub, **b** body wash and **c** toothpaste. Dotted yellow lines indicate the division between smaller (<300 µm) and larger (>300 µm) size classes

By count

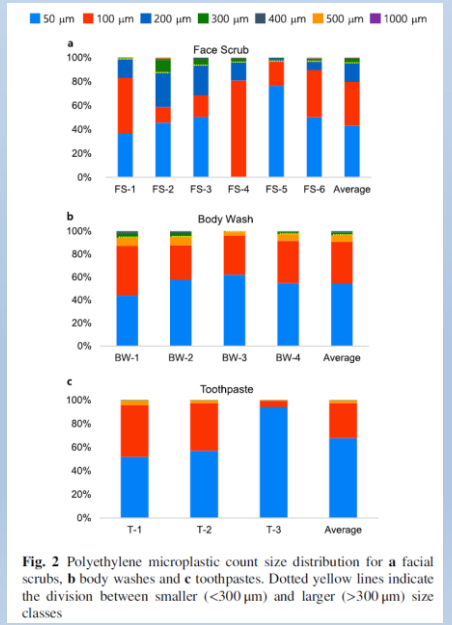


Fig. 2 Polyethylene microplastic count size distribution for **a** facial scrubs, **b** body washes and **c** toothpastes. Dotted yellow lines indicate the division between smaller (<300 µm) and larger (>300 µm) size classes

Conkle et al. (2018) Environmental Management

Microplastics unknown #3:

Are human health risks increased through our ingestion of raw oysters containing plastics harboring a pathogenic biofilm?

Bacterial biofilms colonizing plastics in estuarine waters, with an emphasis on *Vibrio* spp. and their antibacterial resistance

2020. PLOS One

Amanda L. Laverty[1¤a*], Sebastian Primpke[2], Claudia Lorenz[2¤b], Gunnar Gerdts[2], Fred C. Dobbs[1]

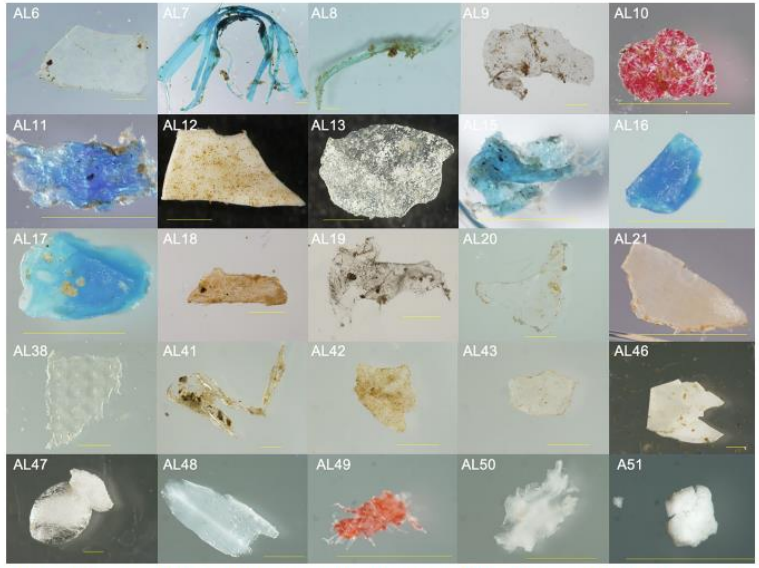


Fig 1. Representative putative microplastics from environmental samples photographed with a stereo-zoom microscope/camera after their collection from surface waters of the Elizabeth River at Old Dominion University's Sailing Center. Samples were collected from June through November 2015. Most pieces were distinctly biofouled. Bars represent one millimeter.

https://doi.org/10.1371/journal.pone.0237704.g001

- Biofilms on microplastics serve as a habitat for bacteria and human pathogens, particularly *Vibrio vulnificus, V. parahaemolyticus,* and *V. cholerae*
- Isolates of these bacteria are variously resistant to antibiotics
- These findings support initial reports of vibrios on microplastics and extend the observation from open ocean to coastal regions
- Marine plastics may disseminate antibiotic-resistance genes